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TREE HAZARD EVALUATION AT MCINTYRE SUMMER HOME TRACT, TULE RIVER RANGER DISTRICT, SEQUOIA NATIONAL FOREST

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ABSTRACT

McIntyre Summer Home Tract comprises 26 home sites in a mixed conifer, giant sequoia, and oak forest at 4900 feet elevation near Camp Nelson along the South Fork of the Middle Fork of the Tule River. A June 1985 tree hazard survey revealed several white firs, pines, and incense-cedars that should be treated to reduce the hazard to residents, visitors, and property. This report describes and locates the hazardous trees, as well as other trees that need pruning or that may become hazardous in future. Management alternatives include no action, treating the hazardous trees, and instituting a systematic tree hazard evaluation program.

INTRODUCTION

McIntyre Summer Home Tract is located near Camp Nelson at 4900 feet elevation in a mixed conifer, giant sequoia, and oak forest on the South Fork of the Middle Fork of the Tule River. It comprises 26 developed summer home sites scattered for almost one mile along both sides of the river. During a visit to the area in 1984 with Resource Officer Chic Spann, I noticed a number of dead and potentially hazardous trees. As a result, the District requested that FPM conduct a complete evaluation of McIntyre Tract. During the first week of June, 1985, I spent two days evaluating tree hazard conditions in the summer home tract.

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OBSERVATIONS

Trees evaluated at McIntyre Tract are illustrated in Figures 1 and 2 (pages 14-15) and in the accompanying Key (pages 16-24). The vegetation differs somewhat on the two sides of the river, contributing to different tree hazard conditions. On the southern or north-facing side, the forest is generally dense and moist, dominated by old-growth giant sequoia, white fir, and sugar pine. On the north, it is drier, with live and black oaks scattered throughout and the overstory dominated by incense-cedar, white fir, and ponderosa pine. Like most forest stands that have reached their pathological rotation age, this one has begun to decline and break apart. Many of the trees are large and very old, and decay organisms and other pests are taking their toll. Standing dead trees and stumps are evident throughout the tract.

Moving systematically through the area, I recorded all live and dead trees and snags that were hazardous, had indicators of potential hazard such as fungal conks, fire scars, wounds, or other defects, or were so close to buildings or other facilities that they would be hazardous if they were to develop defects. The survey results are summarized in Tables 1-5 (pages 5-11). The following describes the tree hazard rating system, hazardous trees and tree parts, predisposing tree defects, and associated fungi and other disease organisms.

TREE HAZARD RATING SYSTEM

I used a hazard rating system modified for use in Sequoia and Kings Canyon National Parks; the system is almost identical to one developed in British Columbia (Wallis et al. 1980). The system rates two elements on a scale of 1-3: **failure potential**, or the likelihood that a tree or tree part will fail, based on the presence of visible defects or defect indicators; and **failure impact**, or the consequences of tree failure, based on the size of the tree or tree part, the likelihood that it will hit the target if it fails, and the value of the target. If a tree has an uncorrected **lean**, an additional 1-point penalty may be assessed.

The **hazard rating** is the sum of the failure potential, failure impact, and lean ratings. Generally, the higher the hazard rating, the greater the hazard. Trees with ratings of 5 or higher are given top priority for removal or other treatment, while those rated 4 are recorded and tagged for periodic reexamination. Trees rated 3 or lower are usually not hazardous, although circumstances may require that such a tree be treated or marked for future observation.

HAZARDOUS TREES AND TREE PARTS

I examined all trees around the homesites, and recorded information on 70 of them (see Map Key on pages 16-24). Of these, 42 received hazard ratings of 5 or higher and should be removed (see Tables 1 and 2). The hazardous trees were predominantly white fir and incense-cedar (Table 3), and more than half (27) were dead (Table 4). Although all trees rated hazardous should be removed, perhaps highest priority should be

given to dead trees and snags, since decay in them is often well-advanced and their stability and wind-firmness are unpredictable. Note that six of the dead trees (Nos. 37-42) were on the hillside above Lots 15 and 16, and hence not within any of the homesites; however, the fire hazard and risk to dispersed recreation that these snags pose should be considered.

A close second priority for treatment are three specific trees (Nos. 13, 27, and 49), plus miscellaneous other trees on nine lots, that should have dead limbs pruned where they overhang houses, trails, roads, and other public areas. Although dead limbs are often sound, it is difficult to examine them closely without climbing the tree. Furthermore, proper removal of dead or overhanging limbs is good arboriculture, and should be a routine practice.

TREE DEFECTS, DECAY INDICATORS, AND DISEASE ORGANISMS

Several tree defects and disease conditions were observed that either are responsible for present hazard conditions or could cause trees to become hazardous in future (see Tables 4 and 5). Note that trees with two or more defects may be hazardous even though each individual defect might not be sufficient to render a tree hazardous.

Snags and Dead Trees. Twenty-seven dead trees and snags were recorded. All are hazardous and should be removed.

Declining and Dying Trees. Six trees were found to have sparse, off-color crowns, poor growth, and other indicators that they may die soon. Although not a direct hazard indicator, a poor crown may be caused by root decay that can predispose the tree to windthrow. Dying trees were also recorded because they should be removed shortly before or after death.

Leaning Live Trees. Twenty trees had noticeable leans. Trees that develop with leans are generally not hazardous because they form structural compensations as they grow. However, all trees that lean toward structures, roads, and trails should be marked and observed to detect any changes in the amount of lean, or any lifting and cracking of the ground at the base. Leaning trees that have other defects or are growing in or near root disease centers are potentially hazardous, and in many cases should be removed.

Root Disease. Fruiting bodies of *Fomes annosus* (cause of annosus root disease and rhizomorphs of *Armillaria* spp. (cause of Armillaria root disease) were found in several fir stumps within the tract. Annosus and Armillaria are common in true fir stands, but *F. annosus* is thought to be the primary cause of root disease, with Armillaria acting as a secondary decay organism. Wherever annosus conks are found in true fir stumps, adjacent old-growth firs with declining crowns, basal wounds, or a combination of defects may have extensive root decay. Unlike pines, true firs are usually not killed by annosus; instead, the fungus decays their roots and causes butt rot, often leading to windthrow during storms.

Other Root Defects. Defects that might lead to failure at the roots included boggy, unstable ground (Tree Nos. 56 and 57) and undermining by flowing water (Tree No. 64).

Basal Defects. Eighteen trees had visible stem defects such as fire scars, open wounds, bleeding, or conspicuous swellings that suggest internal decay. Generally, trees with a central column of decay can lose up to 70 percent of their total diameter inside the bark -- equivalent to a one-third loss in strength -- before becoming hazardous (see pages 3-4 and 24-25 in Wagener, 1963). Increment borings are necessary to determine whether the thickness of the sound wood cylinder is adequate to support a tree with heartrot. Note that any wound or opening through the cylinder will greatly reduce a tree's strength even if the width of the outer sound wood exceeds the minimum standard.

Stem Defects. Twenty-one trees had wounds, open dwarf mistletoe swellings, fire scars, other defects, and fungal conks that can indicate a potential for failure at mid-bole. Two trees had conks of Echinodontium tinctorium, the Indian paint fungus; slow-growing firs with large conks separated by ten feet or more often have extensive decay and are hazardous. One incense-cedar had a Polyporus amarus conk on its stem, and typical pecky rot (pocket dry rot, caused by P. amarus) was detected inside another; in both cases the trees were judged to be marginally hazardous.

Broken, Dead, or Hanging Limbs. Hazardous dead or broken limbs were found in both conifers and oaks. Although most dead branches fall during windstorms, others that are rotted at the base or merely lodged in the crown may fail at any time. Even branches one inch in diameter and smaller can cause injury, particularly if they fall from a great height.

Broken or Dead Tops. Four white firs, one giant sequoia, and one alder had broken or dead tops that could be decayed and hazardous. Large firs that are broken back to a diameter of 6 inches or more are often extensively decayed; new tops that grow upward from these points can be weakly attached and susceptible to breakage.

Other Disease Pests. White fir dwarf mistletoe (Arceuthobium abietinum f. sp. concoloris) infests a number of firs in the tract. This parasite is not a primary cause of hazard, but contributes to it by killing branches, causing bole swellings that are subject to decay, and lowering tree vigor. White pine blister rust (Cronartium ribicola) is present on sapling sugar pines in Lot No. 6; this disease is widespread in the vicinity, and only rust resistant sugar pine should be planted in the tract. Elytroderma disease (Elytroderma deformans) was found on one ponderosa pine, but its effects are presently insignificant.

Table 1. Evaluated Trees by Recommended Treatment, McIntyre Tract, Sequoia National Forest, 1985.

TREATMENT	TREE OR LOT NOS.
Remove	Tree Nos. 1-3, 6-12, 14, 17, 21, 23, 24, 26, 28-30, 32, 45, 51, 52, 56-63, 65-67, 69, and 70
Remove if Fire Hazard & Target Value Warrant	Tree Nos. 37-42
Remove or Observe (see Map Key)	Tree Nos. 13 and 25
Prune Dead Limbs	Tree Nos. 13, 27, and 49 Lot Nos. 3, 10-16, and 27
Observe	Tree Nos. 5, 15, 19, 20, 22, 34-36, 43, 44, 46-48, 50, 53, 54, 64, and 68
No Action at Present	Tree Nos. 4, 16, 18, 31, 33, and 55

Table 2. Evaluated Trees by Lot No. and Recommended Treatment, McIntyre Tract, Sequoia National Forest, 1985.

LOT NO.	TREE NUMBERS BY TREATMENT				
	Remove	Remove/Observe	Prune	Observe	No Action
1	1-3	----	----	----	----
2	[3]	----	----	----	4
3	----	----	X	----	----
4	6-10	----	----	5	----
5	----	----	----	----	----
6	11,12	----	----	----	----
8	14	13	(13)*	----	----
9	----	----	----	15	16
10	17	----	X	----	18
11	----	----	X	----	----
12	----	----	X	19,20	----
13	21	----	X	22	----
14	23,24,26, 28-30	25	X,27	----	31
15	32	----	X	----	33
16	----	----	X	34-36	----
17	----	----	----	43,44	----
18	----	----	----	----	----
19	45	----	----	46,47	----
20	----	----	----	48	----
21	51,52	----	49	50,53,54	----

Table 2 (Continued).

LOT NO.	TREE NUMBERS BY TREATMENT				
	Remove	Remove/Observe	Prune	Observe	No Action
22	56,57	----	----	[54]	55
23	58-63	----	----	----	----
24	----	----	----	64	----
25	65-67	----	----	----	----
26	----	----	----	68	----
27	69,70 [61,62]	----	X	----	----
TOTAL TREES	36	2	2**	18	6

X = Prune hardwoods or conifers near the house (see Map Key).
[] = Tree threatens or may threaten property from an adjoining lot.
* = Branches should be pruned if tree is not removed.
** = Plus miscellaneous hardwoods and conifers on nine lots.

Table 3. Evaluated Tree Species by Size and Hazard Rating, McIntyre Tract, Sequoia National Forest, 1985.

SPECIES	DBH RANGE	NO. OF TREES BY HAZARD RATING <4	4	5	6	Dead	TOTAL NO.
Alder	10-41"	1	0	2	0	2	5
Black Oak	9-19	0	2	0	0	2	4
Giant Sequoia	?-96	0	2	0	0	0	2
Incense-cedar	16-57	4	5	1	1	6	17
Ponderosa Pine	23-52	0	1	0	0	1	2
Sugar Pine	38-49	1	1	0	0	1	3
White Fir	10-53	3	8	7	3	16	37
ALL TREES	9-96"	9	19	10	4	28	70

Table 4. Evaluated Trees by Type of Defect or Decay Indicator, McIntyre Tract, Sequoia National Forest, 1985.

DEFECT OR INDICATOR	TREE OR LOT NOS.
WHOLE TREE DEFECTS:	
Snag or Dead Tree	Tree Nos. 1, 2, 6, 7, 10, 12, 23, 28-30, 32, 37-42, 45, 51, 58, 61-63, 65, 66, 69, and 70
Declining or Dying Tree	Tree Nos. 3, 16, 24, 31, 33, and 56
Leaning Live Tree	Tree Nos. 4, 5, 13, 14, 17, 20, 22, 24, 25, 35, 36, 48, 50, 54, 55, 57, 60, 64, 67, and 68
ROOT DEFECTS:	
Armillaria sp. Rhizomorphs	Tree No. 24
Fomes annosus Conks	Tree No. 24
Other Root Defects	Tree Nos. 56, 57, 64, and 68
BASAL DEFECTS:	
Fire Scar	Tree Nos. 14, 18, 23, 25, 35, 36, 54, and 55
Other Basal Defects	Tree Nos. 3, 19, 26, 34, 43, 44, 48, 50, 52, and 60
STEM DEFECTS:	
Open Bole Swelling (Decay)	Tree Nos. 3, 8, 9, 11, 21, 53, 63, and 67
Closed Bole Swelling	Tree Nos. 15 and 46
Echinodontium tinctorium Conks on Stem	Tree Nos. 24 and 59
Polyporus amarus decay	Tree Nos. 25 and 50
Other Stem Defects	Tree Nos. 13, 17, 19, 20, 26, 47, and 67

Table 4 (Continued).

DEFECT OR INDICATOR	TREE OR LOT NOS.
BRANCH DEFECTS:	
Dead Limbs	Tree Nos. 13, 17, 26, and 27 Lot Nos. 3, 10-16, and 27
Declining or Dying Limbs	Tree Nos. 15, 22, and 24 Lot No. 22
TOP DEFECTS:	
Broken or Dead Top	Tree Nos. 3, 15, 24, 26, 43, and 49
Declining Top	Tree No. 19
Trees Bored to Detect Width of Sound Wood Cylinder	Tree Nos. 11, 13, 14, 18-20, 22, 25, 34, 59, and 60

Table 5. Disease and Decay Organisms, McIntyre Tract, Sequoia National Forest, 1985.

PEST NAME	HOST(S)	TREE OR LOT NOS.
Annosus Root Decay (*Fomes annosus*)	WF	Tree No. 24 Lot No. 8
Armillaria Root Decay (*Armillaria* sp.)	WF	Tree No. 24
Brown Crumbly Rot (*Fomes pinicola*)	WF,SP	Tree Nos. 1, 30, 38, and 49
Brown Stringy Rot (*Echinodontium tinctorium*)	WF	Tree Nos. 24 and 59
Elytroderma Needle Disease (*Elytroderma deformans*)	PP	Tree No. 44
Pocket Dry Rot (*Polyporus amarus*)	IC	Tree Nos. 25 and 50
White Fir Dwarf Mistletoe (*Arceuthobium abietinum* f. sp. *concoloris*)	WF	Tree Nos. 8, 9, 11, 15, 21, 53, 63, and 67 Lot No. 6
White Pine Blister Rust (*Cronartium ribicola*)	SP	Lot No. 6

IC = Incense-cedar SP = Sugar pine
PP = Ponderosa pine WF = White fir

MANAGEMENT ALTERNATIVES

TAKE NO ACTION

If no action is taken to reduce hazard, defective trees and tree parts will fail eventually, occasionally causing property damage, injury, or death. Most trees will fail during winter storms, but some may fall on calm days, without apparent warning. Damage and personal injury claims may be lodged against the permittees or the Forest Service, and settlement will be time-consuming and expensive.

TREAT TREE HAZARDS

Treating hazardous trees described in this report will reduce the risk of failure, property damage, and injury or death. **First**, remove all trees that are rated hazardous because they are dead or defective. In addition, some trees may have become hazardous over winter, and these should be removed also. **Second**, prune all trees with dead or defective limbs that are hazardous to people and structures. **Third**, reexamine trees that were rated marginally hazardous and decide how best to deal with them. Although these steps will not eliminate all hazard, they will substantially reduce the risk from falling trees, tops, and limbs.

DEVELOP A TREE HAZARD EVALUATION PROGRAM

Treating hazardous trees is a minimal requirement of good recreation forest management. Beyond this, however, it would be beneficial to develop a systematic tree hazard management plan for evaluating District recreation sites. Such a plan would enable the District to detect developing tree hazards, evaluate past management actions, improve future efforts, prepare an efficient record-keeping system, and provide continuity in spite of personnel changes. A systematic hazard evaluation plan should include four elements:

Regular Inspection. Tree hazard evaluations must be done at least one a year, preferably in the spring.

Records of Hazard Ratings. Inspectors should keep written records of tree species and size, defects, pests, hazard rating, and control decision for each tree examined; tag trees that are to be monitored or removed; and map trees in relation to structures, campsites, and roads. Written records make it possible for new inspectors to evaluate sites with the benefit of past experience.

Records of Tree Failures. Recording tree failures, their causes, and associated damage enables recreation managers to develop a history of the types of failures peculiar to their site, and helps them evaluate future failure potential. Failure records also provide a check on the effectiveness of hazard tree removal guidelines; repeated failures may indicate that the rating system needs to be recalibrated.

Trained Inspectors. Inspectors should develop expertise through training and field experience. Opportunities include the Hazard Tree Recognition and Recreation-Oriented Pest Management course offered annually by FPM, as well as other seminars that emphasize tree care and maintenance in developed sites. Inspectors should also increase their on-the-ground knowledge of the hazards peculiar to their District's stand and site conditions.

TREE HAZARD REFERENCES

Mills, Lynn J., and Russell, Kenelm. 1980. Detection and correction of hazard trees in Washington's recreation areas. State of Washington, Department of Natural Resources, DNR Report No. 42. 37 pages.

Paine, Lee A. 1971. Accident hazard: evaluation and control decisions on forested recreation sites. U. S. Department of Agriculture, Forest Service, Pacific Southwest Forest and Range Experiment Station, Research Paper PSW-68. 11 pages.

Wagener, Willis W. 1963. Judging hazard from native trees in California recreational areas: a guide for professional foresters. U. S. Department of Agriculture, Forest Service, Pacific Southwest Forest and Range Experiment Station, Research Paper PSW-P1. 29 pages.

Wallis, G. W., Morrison, D. J., and Ross, D. W. 1980. Tree hazards in recreation sites in British Columbia: management guidelines. British Columbia Ministry of Land, Parks, and Housing, and the Canadian Forestry Service, Joint Report No. 13. 52 pages.

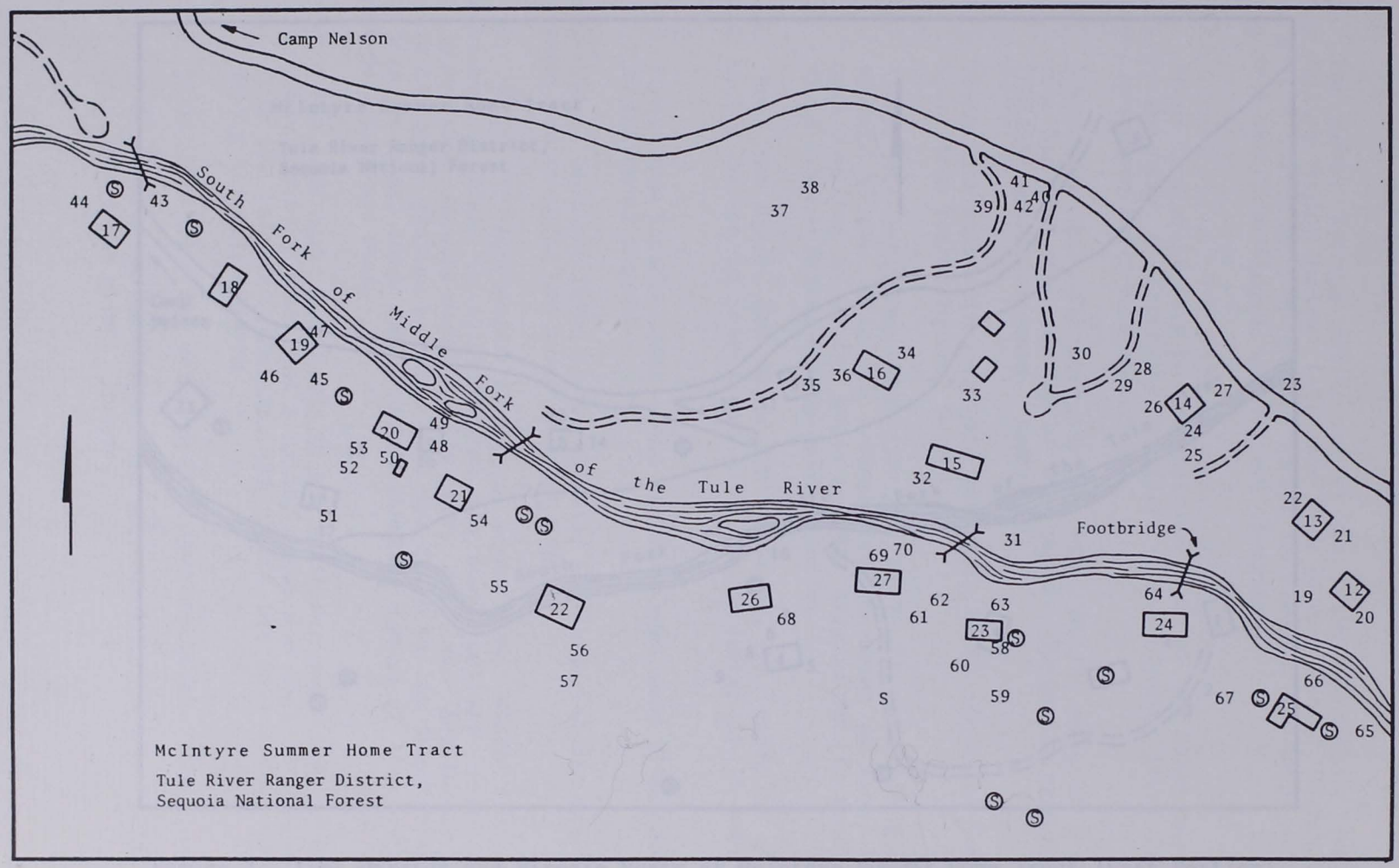

Figure 1. Tree Hazards and Disease Pests at McIntyre Summer Home Tract (West Portion), Tule River Ranger District, Sequoia National Forest, 1985. (Numbers on buildings identify homesites; an "S" within a circle is a live giant sequoia; remaining numbers refer to the Map Key, pages 16-24.)

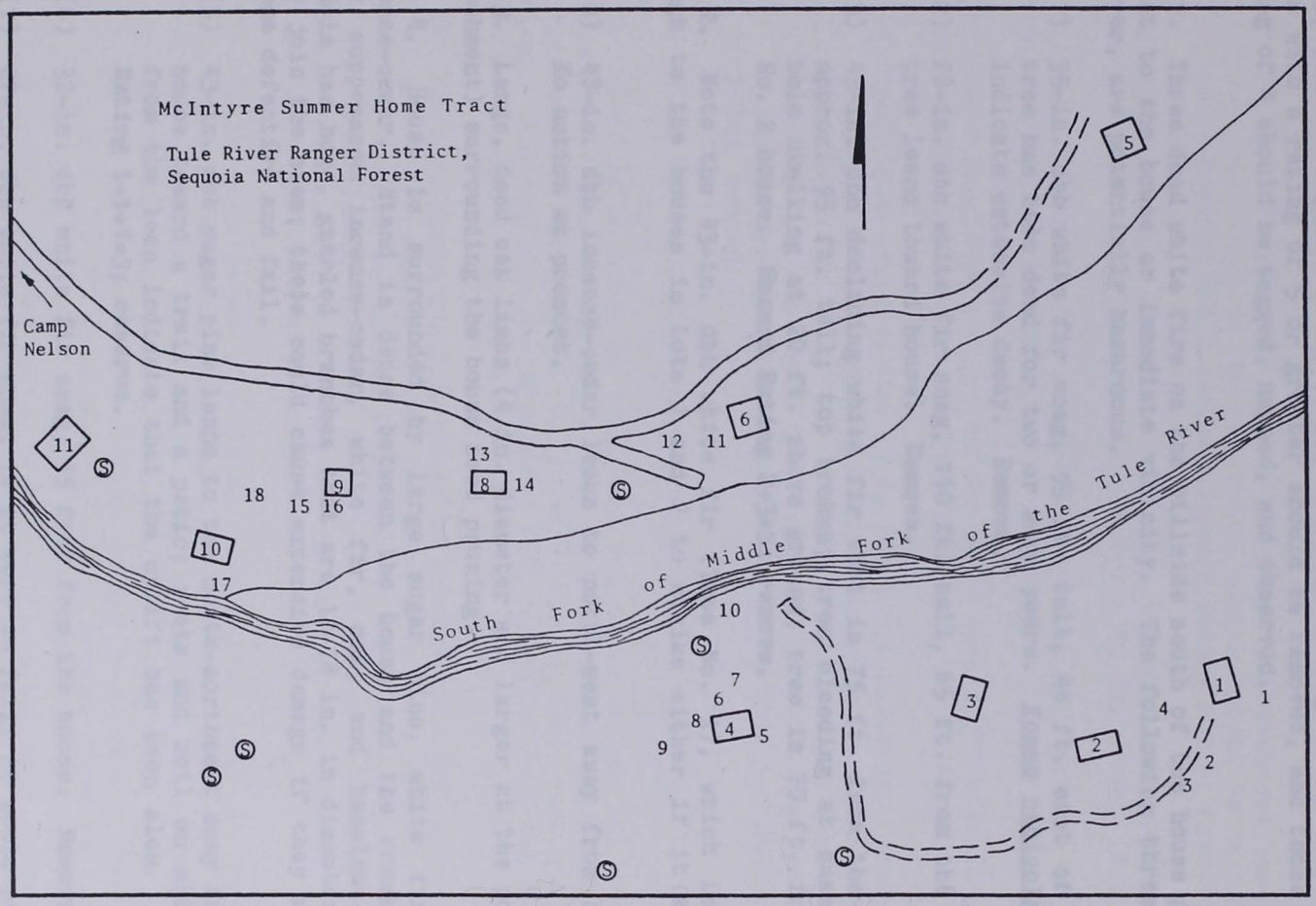

Figure 2. Tree Hazards and Disease Pests at McIntyre Summer Home Tract (East Portion), Tule River Ranger District, Sequoia National Forest, 1985. (Numbers on buildings identify homesites; an "S" within a circle is a live giant sequoia; remaining numbers refer to the Map Key, pages 16-24.)

KEY TO MCINTYRE TRACT TREE HAZARD MAPS

Note: The Hazard Ratings are a sum of the Failure Potential Rating (1-3), Failure Impact Rating (1-3), and Lean Rating (0-1). Generally, trees with a rating of 5 or greater should be removed, and those with a rating of 4 should be tagged, mapped, and observed.

LOT 1. Three dead white firs on the hillside south of the house pose no threat to the house or immediate vicinity. The following three firs, however, are potentially hazardous.

(1) 35-in. dbh white fir snag, 95 ft. tall, 44 ft. east of house; tree has been dead for two or more years. Fomes pinicola conks indicate extensive decay. **Remove.**

(2) 28-in. dbh white fir snag, 110 ft. tall, 65 ft. from the house; tree leans toward house. **Remove.**

(3) 43-in. dbh declining white fir that is 75 ft. from the house, approx. 95 ft. tall; top broken; tree bleeding at base, open bole swelling at 20 ft. above ground; tree is 70 ft. from Lot No. 2 house. **Hazard Rating 2+3=5; remove.**

LOT 2. Note the 43-in. dbh white fir (Tree No. 3), which is close enough to the houses in Lots 1 and 2 to strike either if it were to fail.

(4) 48-in. dbh incense-cedar leans to north-west away from houses. **No action at present.**

LOT 3. Large, dead oak limbs (4 in. diameter and larger at the point of attachment) surrounding the house need pruning.

LOT 4. House is surrounded by large sugar pine, white fir, and incense-cedar. Stand is dense between the house and the creek, with many suppressed incense-cedar, white fir, oak, and hazelnut. The sequoia has huge, gnarled branches that are 12-18 in. in diameter where they join the stem; these could cause extensive damage if they were to become defective and fail.

(5) 43-in. dbh sugar pine leans to the north-northeast away from the house toward a trail and a patio; roots and soil on side away from the lean indicate that the uplift has been slow. **Hazard Rating 1+1+1=3; observe.**

(6) 32-in. dbh white fir snag, 15 feet from the house. **Remove.**

(7) 27-in. dbh white fir snag; if it were to fail, it would probably fall toward the river. **Remove.**

(8) 28-in. dbh white fir with dwarf mistletoe; two large, open, slightly-decayed bole swellings on the side away from the house, one at 4 ft. above ground, the other at 8 ft. **Hazard Rating 2+3=5; remove.**

(9) 23-in. dbh white fir with a dwarf mistletoe-caused swelling on the south side at 12 ft. above ground; wound is flattened in cross-section and bleeding. **Hazard Rating 2+3=5; remove.**

(10) Approx. 40-in. dbh white fir snag, top broken at 55 feet above ground, leaning west toward the trail to the river. **Remove.**

LOT 5. Oaks lean away from the house, and even with defects would pose little threat to the structure.

LOT 6. Dwarf mistletoe present in the white fir; sugar pine is infected with white pine blister rust, and some saplings are being killed.

(11) 21-in. dbh white fir at 25 ft. from the building. Several open or partially open dwarf mistletoe swellings -- one is 1-1/2 ft. wide by 6 ft. high on the north side, open and partially decayed; 12+ in. sound wood on side opposite the wound, scar itself generally sound, decay is probably saprot. **Hazard rating 2+3=5; remove.**

(12) 9-in. dbh dead black oak beside the road. **Remove.**

LOT 7. There is no house on this lot, and hence it was not evaluated. If this lot is ever developed, a tree pest and hazard evaluation should be done **before** construction to prevent future tree care and hazard problems. Publications are available that recommend building practices to prevent damage to trees on forested land.

LOT 8. Conks of Fomes annosus, cause of annosus root rot, were found in several white fir stumps in the vicinity; note that live firs in this area may be exposed to annosus decay and, if their crowns are declining, they may have already suffered extensive root decay. Several live oak and black oak branches up to 4-1/2 in. in diameter are directly over the roof and may pose problems in the future.

(13) 38-in. dbh sugar pine leans toward the house at about 5-10 degrees from vertical; the lean has been corrected slightly. The northwest side of the stem is barren of branches, with a 1-1/2-foot long scar that has healed to a 3 in. wide strip of sound dead wood. An increment boring revealed that there is at least 12 in. of sound wood above the wound. Several 4-6 in. by 8-10 feet long dead branches are attached to the tree above the driveway. **Hazard rating 1+3+(1)=4(5); prune dead branches over driveway, and observe base for root uplift on side by the road; direction of lean may dictate removal.**

(14) 28-in. dbh incense-cedar leaning at about 5 degrees off vertical toward the house, from which it is about 15 ft. away to the east. Top is flat, indicating poor health and possible root

decay. Note the fire scar extending up to 11 feet above ground, 19 in. wide at breast height, and occupying about 21½ percent of the tree's circumference at breast height; sap and heart rot visible behind the scar. Borings indicated incipient decay present in pockets within 15 in. of generally sound wood. **Hazard rating 2+3+1=6; remove.**

LOT 9.

(15) 23-in. dbh white fir at 32 ft. from the house. Dead top, dwarf mistletoe rating (DMR) 6, dying branches, many closed dwarf mistletoe swellings on the stem. **Hazard rating 2+2=4; observe.**

(16) 22-in. dbh white fir at 5 ft. from the house; slowly dying, many small dead branches, no lean, top alive. This and other declining white firs in the vicinity should be removed shortly before or immediately after death, since, once dead, they are likely to decay rapidly and become difficult to remove safely. **No action at present.**

LOT 10. Creekside alders contain 4-6 in. diameter dead limbs that should be removed.

(17) 15-in. dbh alder at riverside with many dead branches, leans toward the house and into a live alder; stem cracked at 5 ft. above ground on the side toward the river. Tree leans at about 30 degrees off vertical toward the paved area beside the house. **Hazard rating 2+2+1=5; remove.**

(18) 44-in. dbh incense-cedar at about 40 ft. north of the house, no lean. One ft. high by 2 ft. wide fire scar on the north with some sap rot; at least 10 in. sound wood on the north side. **Hazard rating 1+2=3; no action at present.**

LOT 11. Sequoia has very large limbs, all alive. Consider removing small dead oak limbs near the porch, and 5 in. diameter dead limbs on an alder beside the trail to the creek.

LOT 12. Note small dead oak limbs near the house; prune as needed.

(19) 47-in. dbh incense-cedar at 15 ft. from the house on this lot and 35 ft. from the house on Lot 13; a crook in the stem at 30 ft. above ground, where an old dead branch emerges (possible decay?); signs of bird entry into the bole at 12 ft. above ground and elsewhere on the stem, suggesting that there may be pockets of decay; 12 in. sound wood on the north above a squirrel hole at the base. Top is declining. **Hazard rating 1+3=4; observe.**

(20) 19-in. dbh black oak leans over the porch at about 35 degrees off vertical; an 18 in. adjacent stem has been cut, leaving a stump with a 10 in. diameter central hollow. Oak has at least 7 in. sound wood on the south side, and several healed cracks on the stem. **Hazard rating 1+2+1=4; observe.**

LOT 13. Small oak limbs near the house should be trimmed.

(21) 21-in. dbh white fir at 7 ft. from the house, with an open, decayed dwarf mistletoe bole swelling at 9 ft. above ground on the south, 5 ft. long and extending around one-half the tree's circumference; tree is 35 ft. from the house on Lot 12. **Hazard rating 3+3=6; remove.**

(22) 27-in. dbh white fir at 15 ft. from the house, with a slightly corrected lean toward the house; some branches are dying; bleeding on the south side; increment boring revealed undecayed wetwood and sound wood to the center. **Hazard rating 1+3=4; observe.**

LOT 14. Prune the dead limbs on the black oak near the parking area.

(23) 29-in. dbh incense-cedar snag across the road from the lot, top leaning into and hung up in a white fir; tree is over the power line, has an unidentified white-rot decay fungus in the roots, and a fire scar on the side away from the road. **Remove.**

(24) 53-in. dbh white fir leaning 10 degrees off vertical to the southeast toward the parking area, path, and bridge; four 6-10 in. diameter Echinodontium tinctorium (Indian paint fungus) conks around stem between 15 and 25 ft. above ground. Armillaria root decay (caused by an Armillaria sp.) visible on gnarled roots at base, and small Fomes annosus conks (popcorn conks) at the duff line on the north side. Top broken out at about 24 in. diameter, stem dead back about 30 ft., extensive branch dieback and other signs of decline. **Hazard rating 3+2=5; remove.**

(25) 22-in. dbh incense-cedar leans at 15 degrees off vertical toward the house and into a 53-in. dbh white fir (Tree no. 24; see above); fire scar around 40% of the tree's circumference at the base on the east, open up to 12 ft. above ground. Increment boring near fire scar at 2-1/2 ft. above ground revealed 5-1/2 in. sound wood, and then next 3-1/2 in. contained several 1/4 in. wide pockets of rot (caused by the pecky rot fungus, Polyporus amarus). Tree leans toward side of white fir away from the house. **Hazard rating 2+2=4; observe, or else remove with the 53-in. white fir (Tree No. 24).**

(26) 50-in. dbh incense-cedar with 6-8 in. diameter, long-dead limbs that hang over the porch; has an 8-ft. tall by 3-ft. wide open scar on the southeast, with a 24-in. deep hole at the base beneath the scar. Top is dead back about 15 ft. **Hazard rating 2+3=5; remove.**

(27) 43-in. dbh incense-cedar with several 3-5 in. diameter by 15-20 ft. long dead limbs; **remove dead limbs.**

(28) 18-in. dbh dead white fir near outhouse; **remove.**

(29) 26-in. dbh white fir snag, broken at 45 ft. above ground, posing some threat to roadway and to pedestrians; **remove.**

(30) 27-in. dbh white fir snag, broken at 40 ft. above ground, with two Fomes pinicola conks on the stem; poses some threat to the roadway and to pedestrians; **remove.**

(31) 21-in. dbh white fir that will probably die later this year; remove as soon after death as possible. **No action at present.**

LOT 15. Trim dead black oak limbs that overhang the roof of the house.

(32) 11-in. dbh dead white fir beside the porch; **remove.**

(33) 13-in. dbh white fir growing beside a four-stemmed black oak, doing very poorly and probably dying this year; remove as soon after death as possible. **No action at present.**

LOT 16. There are many dead oak limbs in the vicinity of the house and surrounding trails; note hazardous limbs and remove. Sequoias at this site are huge but their crowns are apparently healthy.

(34) 18-in. dbh black oak has an open 8-in. diameter cavity on the east side at the base, with evidence that rodents have been burrowing underneath and perhaps into hollows in the roots and lower stem. At 2-1/2 ft. above ground on the east, the diameter inside the bark is about 18 in. and the central hollow is about 9 in. in diameter; sufficient structure at this point to support the tree. **Hazard rating 2+2=4; observe.**

(35) 42-in. dbh incense-cedar with a slight, corrected lean parallel to the river-side front of the cabin; fire scar on the east side around 45% of the tree's circumference. **Hazard rating 2+2=4; observe.**

(36) 41-in. dbh incense-cedar growing at 8 ft. from the cabin; a fire scar at the base on the north encompasses about 25% of the tree's circumference; upper stem sweeps toward the cabin at about 10 degrees from vertical; the weight of the branches is concentrated on the side of the tree toward the cabin. **Hazard rating 1+3=4; observe.**

HILLSIDE NORTH OF LOTS 15 AND 16. There are several large dead trees in this area that could pose some hazard to vehicles or to hikers. If these trees are not being protected for wildlife habitat, a combination of failure potential and fire hazard may dictate their removal.

(37) 49-in. dbh dead incense-cedar. **Remove?**

(38) 49-in. dbh dead sugar pine with several Fomes pinicola conks. **Remove?**

(39) 23-in. dbh dead ponderosa pine. **Remove?**

(40) 41-in. dbh dead incense-cedar. **Remove?**

(41) 36-in. dbh dead incense-cedar. **Remove?**

(42) 29-in. dbh dead incense-cedar. **Remove?**

LOT 17. Two very large conifers would pose a significant threat to the house or its occupants if they were to fail. However, the scenic value of these trees is substantial, and their great size would make any treatments very expensive.

(43) 96-in. dbh sequoia with live cambium on an approximately 3-foot wide strip on the west side, comprising less than 15% of the circumference. Top is dead back 100 ft. or more, but it is impossible to know its condition without climbing the tree and checking first-hand. **Hazard rating 2+2=4; observe this tree closely -- take photos of the tree in sections, and compare them annually with the present crown condition, noting any new dead branches, increased top dieback, or other changes.**

(44) 52-in. dbh ponderosa pine with a 10-ft. long by 10-in. wide opening on the west side; some Elytroderma deformans in the crown. Tree is 206 ft. tall, with the lower edge of the crown starting at 60 ft. from the ground. **Hazard rating 1+3=4; observe.**

LOT 18. No comments about the trees on this lot.

LOT 19.

(45) 14-in. dbh black oak snag with unidentified decay conks at the base. **Remove.**

(46) 19-in. dbh white fir with a prominent swelling around the stem at 20 ft. above ground; probably no defect. **Hazard rating 1+3=4; observe.**

(47) 19-in. dbh white fir has grown into the deck railing, disrupting the growth of approximately 1/3-to-1/2 the diameter of the tree; tree is apparently healthy, without decay, but may decline as the injury continues. **Hazard rating 1+3=4; observe (perhaps redesign deck to reduce impact on tree).**

LOT 20.

(48) 33-in. dbh white fir with a corrected lean toward the porch at about 5 degrees off vertical; defect at base on the inner side of the lean, some decay apparent. An old stem adjacent to the fir at its base is extensively decayed; however, despite some saprot at about one in. above ground line, the heartwood of this fir is sound. **Hazard rating 2+2=4; observe.**

LOT 21.

(49) 21-in. dbh alder with one dead stem about 25 ft. long. **Remove dead portion of tree.**

(50) 56-in. dbh incense-cedar with an old Polyporus amarus conk at 40 ft. above ground on the southeast; 3-ft. wide wound at the base on the north side; tree leans at 5 degrees off vertical to the southeast. **Hazard rating 2+2=4; observe.**

(51) 25-in. dbh white fir snag on the hill above the cabin. **Remove.**

(52) 25-in. dbh white fir with an open wound at the base on the southwest; extensive decay at least 18 in. deep at ground line. **Hazard rating 3+3=6; remove.**

(53) 18-in. dbh white fir with an open dwarf mistletoe swelling around 1/2 of the stem on the northeast side; burl is sound except for decay in outer 1-1/2 in. of sapwood. **Hazard rating 1+3=4; observe.**

(54) Sequoia leans at 5-10 degrees off vertical toward a point just uphill from the house on Lot 22; if it were to fail, it might hit nearby firs and knock them into the house. Fire scar encompasses 40% of the diameter of the sequoia on the east-to-east-southeast side. **Hazard rating 2+2=4; observe tree for soil uplift at the base on the side away from the lean.**

LOT 22. Closest giant sequoia has huge declining branches that may become a hazard in future.

(55) 57-in. dbh incense-cedar leaning 5 degrees off vertical toward the corner of the porch; open fire scar on the east side to 5 ft., heartwood beneath is solid. **Hazard rating 1+1+1=3; no action at present.**

(56) 16-in. dbh incense-cedar, almost dead, standing in a waterlogged hillside bog. **Remove.**

(57) 26-in. dbh alder, leaning 15 degrees off vertical toward the corner of the house, and growing in the drainage channel of the hillside bog. **Hazard rating 1+3+1=5; remove.**

LOT 23. Sequoia on this lot is apparently sound, but other dead and defective conifers have a high failure and impact potential.

(58) 39-in. dbh white fir snag leans against the adjacent sequoia. **Remove.**

(59) 32-in. dbh white fir with Echinodontium tinctorium conks ranging in size from 4-12 in. in diameter at 8 ft., 12 ft., and 30 ft. (two conks) above ground; bored tree at breast height on the east (5 ft. directly below small 4-in. diameter conk), finding

10 in. sound wood followed by 2 in. of both sound and incipiently-decayed wood. **Hazard rating 2+3=5; remove.**

(60) 45-in. dbh white fir 25 ft. from house, leaning at 10-15 degrees off vertical toward the house; lean partially corrected; large open wound at base on uphill (south) side, with an open cavity about 26 in. deep; increment boring showed 14+ in. sound wood on the north side opposite the cavity. **Hazard rating 2+3+1=6; remove.**

(61) 31-in. dbh white fir snag; threatens house on Lot 27 also. **Remove.**

(62) 35-in. dbh white fir snag; threatens house on Lot 27 also. **Remove.**

(63) 26-in. dbh white fir snag with open dwarf mistletoe swellings at 8 ft. and 14 ft. above ground. **Remove.**

LOT 24. Sequoia has large live branches, but no obvious widow- or widower-makers.

(64) 29-in. dbh white fir about 20 ft. from the house and situated beside the river, partially undermined by the water; corrected lean to the east over the edge of the house; top alive. **Hazard rating 1+3=4; observe.**

LOT 25. Two sequoias on this lot have large limbs, but are generally healthy. One smaller sequoia has been cut since the original map was drawn, but the reason is unknown.

(65) 12-in. dbh white fir snag by river, within range of the house. **Remove.**

(66) 21-in. dbh alder snag with a phone line attached, leans slightly across the river; rotted and partially undermined by water. **Remove.**

(67) 26-in. dbh white fir at 45 ft. west of the house, leaning at 5 degrees off vertical toward the house; middle of top is bent, suggesting that old, dead tops may be buried at that point, with some internal decay possible. Dwarf mistletoe rating 3, with a partially open mistletoe swelling on the west side. Wooden 2x4 cross-bar attached on the east side of the main stem, indicating a possible weak point; at least 10 in. sound wood 3 ft. below the scar. **Hazard rating 2+3=5; remove.**

LOT 26.

(68) 43-in. dbh white fir 12 ft. from the house, leaning at 10 degrees off vertical and away from the house; possibility of annosus decay from adjacent cut fir stump on the side opposite the lean; at least 9-1/2 in. sound wood on the south side. **Hazard rating 1+3=4; observe for root uplift.**

LOT 27. Two fir snags on Lot 23 (Tree Nos. 61 and 62) are a threat to this house as well. Large incense-cedar and sequoia by the front porch have several long, 4-8 in. diameter dead branches that should be removed.

(69) 10-in. dbh dead white fir; if it failed, it could hit the porch. **Remove.**

(70) 10-in. dbh dead alder; if it failed, it could hit the porch. **Remove.**

APPENDIX: GLOSSARY OF TREE HAZARD TERMS

TREE HAZARD. Simply put, the risk (or hazard) that any falling tree or tree part will cause property damage, injury, or death. This risk is never zero: wherever there are trees -- in forest, park, city, or suburb -- there is always some chance that a tree may fail.

The tree hazard concept assumes that trees, in addition to their aesthetic, timber, and other values, are also potentially hazardous; any valuation of trees must consider their potential hazard weighed against their obvious benefits.

HAZARDOUS (or HAZARD) TREE. Although all trees are potentially hazardous, only trees that meet the following criteria are rated for degree of hazard:

1) **The tree or any of its parts is within striking distance of a temporary or permanent structure, or any site where people walk, drive, park, sit, reside, or otherwise congregate.** Trees in forests or parks that people never visit cannot be hazardous, no matter how defective.

2) **The tree or tree part contains some defect in structure that predisposes it to failure.** In most cases, a trained inspector will be able to identify the defect by signs or symptoms of one or more insects, pathogens, or other defect indicators. However, the presence or severity of some defects cannot be known in advance, and some trees without visible defects may fail.

3) **If the whole tree or any part were to fail -- either because of adverse weather events or in the absence of any such impetus -- it could cause property damage, personal injury, or death.**

TREE HAZARD EVALUATION. The process by which a trained inspector identifies trees that could cause damage to people or property, evaluates them for defects in structure, assigns a tree hazard rating, maps and records his findings, and recommends a treatment. Usually, the inspector also collects tree species, size, and crown shape data, and specifies the target and its use patterns.

TREE HAZARD PROGRAM. The goal of a tree hazard program is to reduce hazard from falling trees or tree parts so that the public can be reasonably safe. Generally, the uncertainty involved in assessing certain tree defects -- plus competing demands for shade, screening, beauty, and other values -- make it impossible to eliminate all hazard.

A tree hazard program should have several elements: a regular, systematic site inspection procedure; trained inspectors; a numeric or descriptive hazard rating system; good record-keeping, including maps and

data sheets; aggressive action to treat hazardous trees as soon as they are identified; and, continual reassessment of tree failures and accidents to learn how the rating system can be improved.

TREE HAZARD CONTROL. Tree hazard control or treatment is a necessary step in any tree hazard program. Treatments include removal of tree parts, whole trees, or the target, and structural enhancement (cabling and bracing); generally, cabling and bracing are not options in forested recreation areas. In some cases, recreation sites with a history of failures may be evacuated or closed during adverse weather conditions.